Intrinsically stable shirred stick

The invention relates to an intrinsically stable shirred tubular food casing, and also to the use of the shirred casing on fully automatic stuffing apparatuses, in particular automatic sausage stuffing and clipping devices or twisting apparatuses.

Food casings, especially sausage casings, are predominantly offered in shirred form. In each case about 10 to 200 m of the casing are shirred to form a 5 to 200 cm long stick. Shirring artificial sausage skin has long been known and numerously described. On an industrial scale, shirring is performed using special machines. The casing which is delivered as roll product is taken off from the roll, inflated and pulled onto the shirring mandrel of the shirring machine. The outer diameter of the shirring mandrel determines the inner diameter of the stick to be produced. Shirring is a high stress load for the casing. Thus, too high a shirring ratio frequently leads to damage of the casing. To make the casing more supple and to reduce the mechanical friction load of the shirring systems, it is therefore customarily sprayed or wetted, immediately before shirring, or during shirring, from the inside, from the outside, or from both sides, with water, oil or an oil-in-water emulsion. This measure further prevents cracks or damage occurring at the pleats forming during shirring. The food casings thus produced are predominantly provided after the shirring process with a net-type or reinforcing packaging, so that the casings can be handled in the further processing procedure.

Cellulose-based food casings shirred in this manner have already been known for a long time. They may also be shirred in such a manner that intrinsically stable sticks are formed which are suitable for fully automatic further processing (DE-A 100 09 979). The casings are used in particular as peelable skin, for example in the production of small sausages. Cellulose skins are always shirred in the moist state. After the stick has been pulled off the shirring rod, a dimensionally stable or self-supporting shirred stick is present.

Shirred sticks made of tubular polymer-based food casings are also known. These shirred sticks, however, are generally not very stable without net-type or reinforcing packaging (see G. Effenberger, Wursthüllen - Kunstdarm [Sausage casings, artificial sausage skin], 2nd Edition [1991] pp. 58-60). In order to be able to ensure the dimensional stability of these shirred sticks, these food casings, after the shirring process, are given a reinforcing packaging. The different embodiments can comprise, e.g. shirring sleeves, tubing or net-type packaging. For transport, the shirred sticks with or without shirring sleeve are generally enclosed by a pouch or a tubular net. The shirring pleats of the polymer-based casings show a relatively high resilience, which leads to the fact that the shirred sticks without reinforcing packaging do not retain their original shape, but expand again. As a result, the mechanical intrinsic stability of the casings decreases, however, so that they can no longer be used on fully automatic stuffing apparatuses. Frequently, the skin shirred onto a sleeve is therefore fixed using limiting disks. The previously known shirred sticks, at least those without shirring sleeve, must therefore be opened either by hand or at least pushed onto the stuffing horn by hand, and then freed again from the respective reinforcing packaging which makes fully automatic operation impossible.

DE-A 196 25 094 A1 (US-A 5 928 738) discloses a biaxially stretch-oriented and heatset single-layer or multilayer stick form polyamide-based packaging casing which has a shirring density of up to 1:200 at a length of the shirred stick of 40 to 100 cm, and also a method for producing such a packaging casing. The wall thickness of the packaging casing is in a range from 10 to 50 µm. Before this packaging casing is shirred, a spray solution is applied, which spray solution contains, as shirring lubricant, an emulsifier, paraffin oil or similarly active agent.

Shirred sticks having a compression ratio of up to about 150 made of an at least three-layer tubular casing are disclosed by EP-A 1 013 173. The casing has one polyamide layer each on the inside and outside. Between these

layers is situated a water vapor-barrier layer, for example based on polyolefin. The casings, before shirring, are sprayed on the outside with water which can additionally contain a fungicide or preservative, and then stored in a water vapor-tight packaging, so that the water can migrate into the external polyamide layer. It is premoistening which permits the shirring with said high compression ratio.

In the older application, which was unpublished at the priority of the present application, EP-A 1 338 204, a packaging casing is disclosed which is shirred at a shirring ratio of 1:200 or higher. The high shirring ratio is achieved by the surface of the casing and that of the shirred stick together having a mean surface roughness of 0.5 to 5.0 µm. This achieves the shirred stick being able to be taken off from the shirring rod without damage. Preferably, here also, the casing is sprayed before shirring with a solution which comprises a shirring lubricant.

In the abovementioned documents, shirred sticks having high compression rates are described. Still-present resilience of the shirring pleats, the shirred sticks, however, are not intrinsically stable and are therefore customarily provided with a reinforcing packaging.

The object was therefore still to provide a shirred stick made of a tubular polymer-based food casing which does not require additional reinforcing packaging of the previously known sticks and which can be further processed without problems on fully automatic stuffing apparatuses. The shirred stick, without shirring sleeve or other separate support, is to be so stable and retain a substantially straight shape that it can be taken from a transport container and, e.g., can be placed into the storage vessel (hopper) of the stuffing machine, in which the stick is fully automatically fed to the stuffing horn.

It has been found that tubular casings based on synthetic polymers can also be shirred to form intrinsically stable sticks if they experience, enough

compression of the shirring operation in the shirring pleating, sufficient folding stress which does not recover. Surprisingly, it has been found, that also thick-walled casings having non-elastic characteristics develop this intrinsic stability if, in the compressed state, they are set for a period (up to 24 hours). This setting can be carried out, for example, via a reinforcing packaging or storage under vacuum in a close-fitting, air-tight film packaging. In this time, owing to the setting of the shirring pleats, the tension or the resilience recedes completely. The breakdown of this resilience in particularly thin and soft or elastic materials at the same time as the compression in the currently customary and employed shirring processes is likewise surprising. Furthermore, it has been found that particularly high insensitivity to bending and folding stress can be achieved by a targeted shirring pleating. In this case, the contact surface area and frictional surface area enlargement of the shirring pleats among one another is of particular importance. This contact surface area enlargement can be achieved, in particular, via overlapping shirring, as achieved in an ideal manner by a screw shirring method. In addition, it has been found that the intrinsic stability of the shirred stick can be still further increased by an adhesion-promoting treatment or impregnation of the casing surface, for example by an oil or water film. This may also be achieved by a corona treatment. In the shirred sticks, the casing exhibits only very low resilience, or none at all, so that the pleats formed on shirring can no longer open. The shirred pleats retain rather their shape once achieved.

The present invention therefore relates to an intrinsically stable shirred tubular single-layer or multilayer food casing which essentially consists of synthetic polymers and, without net-type or reinforcing packaging, has sufficient intrinsic stability to be processed on fully automatic stuffing machines. The casing is preferably compressed in a ratio of 100:1 or more.

In a preferred embodiment, the sigma-5 value (longitudinal/transverse, measured wet) is below 20/20 N/mm^2, particularly preferably in the range from 2/2 to 10/10 N/mm^2.

The low resilience or the absence of resilience can be recognized from the fact that the casing, after shirring, extends in the longitudinal direction by no more than 15 %, preferably by no more than 10 %, particularly preferably by no more than 5 %, when it is stored on a smooth, planar support, usually on a glass plate, without net-typ or film packaging or the like, at room temperature (i.e. 23 °C) and 60 % relative humidity (rh).

The mechanical stability of the inventive shirred stick is demonstrated, for example, in the fact that it bends under the effect of its own weight by no more than 20 %, preferably by no more than 5 %, based on the length between two support points, (storage at room temperature and 60 % rh). A correspondingly long stick which is mounted on two support points which lie 30 cm apart therefore bends under said conditions by no more than 6 cm, preferably by no more than 1.5 cm. A shirred stick which is stable in such a manner meets the conditions for fully automatic processing.

The inventive casing is preferably single-layered. It generally has a wall thickness of no more than 90 µm, particularly preferably from 15 to 30 µm. The casing is generally shirred in a ratio of 100:1 or more, i.e. for example 50 m of the casing give a shirred stick of at most 50 cm in length (= compression ratio of at least 100:1). Preferably, the compression ratio is even higher still, for instance in the range from 120:1 to 500:1. Methods and apparatuses used for producing the shirred sticks having such a high compression ratio are disclosed, for example, in EP-A 1 338 204 which was unpublished at the priority of the present application.

An important constituent of the casing is preferably "soft" synthetic polymers or polymer mixtures. To these belong aliphatic polyamides and aliphatic copolyamides such as nylon 6/66 (obtainable, for example, under the name ®Ultramid C4 from BASF AG) or nylon 6/12 (obtainable, for example, under the names ®Grilon CF6S or ®Grilon BM 13 from Ems Chemie AG), polyether block amides (e.g. ®Grilon FE 7012 or ®Pebax MH 1657 from Elf Atochem

S.A.). In combination with other polymers, the casing can also comprise water-soluble polymers, such as polyvinylpyrrolidone or partially or completely saponified polyvinylacetate. Suitable polymers are also ionomers, such as ethylene/(meth)acrylic acid copolymers, or (meth)acrylic ester polymers (especially ethylene/methyl acrylate copolymers, ethylene/ethyl acrylate copolymers or ethylene/butyl acrylate copolymers). Further suitable polymers for the inventive casing are polyurethanes (e.g. ®Irogran VP 456/40), copolyesters (e.g. ®Arnitel PM 381 or PM 581) and biodegradable polyesters (e.g. ®Ecoflex).

Alternatively, or in addition, the required soft quality of the casing can also be achieved by adding monomeric plasticizers. These are, for example, dimethylsulfoxide (DMSO), butane-1,3-diol, glycerol, water, ethylene glycol, propylene glycol, butylene glycol, diglyceride, diglycol ether, formamide, N-methylformamide, N,N-dimethylformamide (DMF), N,N-dimethylurea, N,N-dimethylacetamide, polyalkylene oxide, glycerol mono-, di- or triacetate, sorbitol, erythritol, mannitol, gluconic acid, galacturonic acid, glucaric acid, glucuronic acid, polyhydroxycarboxylic acids, glucose, fructose, sucrose, citric acid and citric acid derivatives and also any desired mixtures thereof. Some of said plasticizers can also be applied to the already fabricated food casing. For example, the casing can be passed through an aqueous plasticizer bath which contains glycerol.

In a particular embodiment, the adhesion of the individual shirred pleats to one another is increased, for example by a corona treatment. The surface tension after this treatment is expediently 40 to 50 mN/m, preferably 50 to 70 mN/m.

The casing preferably has a nominal caliber of no more than 40 mm. It is thus suitable in particular for use as peeling skin. However, polymer casings having a greater caliber can also be processed to form intrinsically stable sticks.

The water vapor permeability of the casing is essentially determined by type

and fraction of the synthetic polymers used. Generally, the water vapor permeability is 5 to 1000 g/m^2 d, preferably 20 to 400 g/m^2 d, particularly preferably 50 to 200 g/m^2 d, determined as specified in DIN 53 122 at 23 °C.

Expediently, the shirred food casing is closed at one end, for example by a metal or plastic clip. The closure at one end can also be performed by twisting the casing itself or by welding or gluing.

Shirring machines and shirring apparatuses for producing the inventive intrinsically stable shirred casing are known and are described, for example, in the abovementioned EP-A 1 338 204. The shirring elements form, for example, a spiral, axial or screw system. They lead to the formation of shirred pleats which are essentially directed perpendicular to the machine direction, or of those which are at an incline and substantially overlap one another. Shirred sticks having the last-mentioned pleat structure are generally preferred. They may be produced particularly expediently using a screw system.

If appropriate, before the shirring or during the shirring, a shirring lubricant is applied to the tubular casing. Expediently, this agent is sprayed onto the inside and/or the outside. A particularly suitable shirring lubricant is, for example, paraffin oil. Depending on the type of the casing, it can also be employed in the form of an oil-in-water emulsion. An impregnation can also be applied to the inside of the casing, which impregnation specifically controls the sausage emulsion adhesion and e.g. improves the peeling of the casing.

By means a temporary setting of the shirring geometry and the resultant breakdown in tension of the shirred pleats, the required intrinsic stability of the stick is achieved.

The example hereinafter serves to illustrate the invention.

Example

A single-layered soft smokeable polymer casing made of 20 % by weight polyether block amide, 20 % by weight polyvinyl alcohol and 60 % by weight nylon 6/66 having a σ_5 value of 2/2 N/mm^2 (longitudinal/transverse) and a water vapor permeability of 200 g/m^2 d (determined as specified in DIN 53 122 at 23 °C; moisture gradient 85 %/0 % rh) was premoistened with water on a rewinder. In each case 24.4 m of the casing were then shirred on a shirring machine having an axial shirring system to give an intrinsically stable stick of 17.5 cm in length. During the shirring operation, the outside of the casing was sprayed with paraffin oil. An impregnation to improve the peeling properties was sprayed onto the inside (via a shirring mandrel equipped with spray nozzles). A plurality of the sticks were packed into a pouch using an automatic packing system and welded under vacuum.

The sticks were then removed from the pouch and placed into the feed hopper of a fast-running stuffing machine (Frank-A-Matic), from where they were fully automatically fed to the stuffing horn. In this manner, up to 2 tons of sausage emulsion could be processed per hour to small sausages of a caliber of 24 mm. Subsequently, the small sausages, as customary, were smoked and cooked. After cooling, the casing was peeled off on an automatic unit; the then casing-less small sausages were then placed in glass jars and sealed.

An equally long (17.5 cm) stick of a cellulose-based peeling skin comprises, in contrast, generally only 12.19 m of tubular casing. By means of the inventive shirred stick, the stuffing performance could therefore be increased by 25 %.

In addition, the invention relates to the use of the shirred food casing on a fully automatic stuffing apparatus, preferably on fully automatic sausage stuffing, portioning, clipping and twisting apparatuses.